Preparation or Barriers to Entry? A Quasi-Experimental Study on the Effects of High School Science on College Major Choices

Jing Zhang, Texas A&M University

Introduction

STEM shortage is real (Bureau of Labor Statistics; Department of Education, 2022), and the top obstacle to advance science and technology in the US is the quality of K-12 STEM education (Science & Technology Action Committee, 2024). This paper investigates whether and to what extent accessing more varieties of advanced science in high school affects the likelihoods of students' choosing a STEM major in college, using the rich micro data from the Texas Education Research Center. I do so by exploiting a rule in Chapter 74 of Texas Administrative Code (TAC), which regulates a discontinuity in minimum offerings of science courses by school districts according to their high school enrollment sizes.

Methods

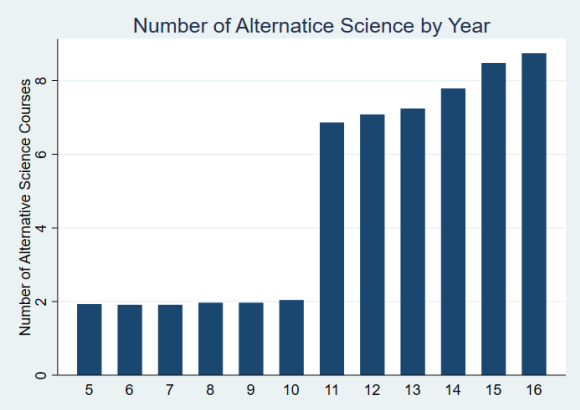
I implement a regression discontinuity design around the 500 high school enrollment cutoff, to compare students in larger and smaller districts around the cutoff.

The basic estimation equation is the following:

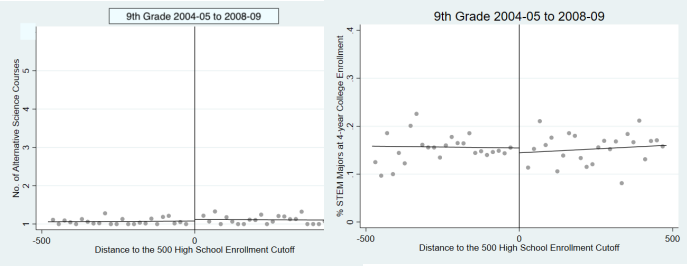
$$Y = \alpha + \beta * enroll + \theta \cdot 1(enroll >= 500) + X\beta + D + \epsilon$$

Where *enroll* is the running variable, 1(*enroll* >=500) is the treatment indicator, *X* are the student demographics, and *D* are the cohort dummies.

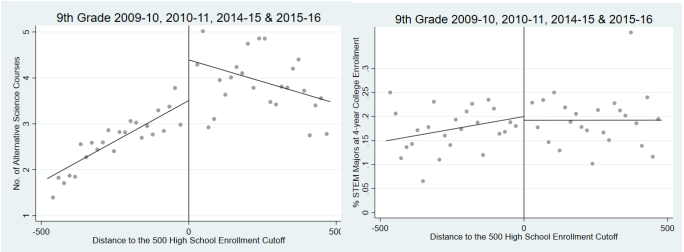
Expansion in Science



Course & STEM Majors in the Pre-Periods



Course & STEM Majors in the Post-Periods



The Natural Experiment

In the past decade, Texas expanded the high school science curriculum with two house bills in 2009 (HB3) and 2013 (HB5) to prepare graduates with both academic and career readiness. More field science courses have been added to the advanced science list, beyond Biology, Physics, and Chemistry.

To reasonably increase course offerings, the Texas Administrative Code Chapter 74 sets a minimum of two offerings for districts serving more than 500 high school students and one for districts serving less than 500 high school students. Empirically, the differential minimum offering requirement resulted in one more alternative science being offered in larger districts (>=500 high school students) on average, immediately following the implementation of the house bills in 2011 and 2016. The difference faded away over time, with smaller districts catching up with the larger districts in the number of alternative science courses offered in the remaining years.

Discontinuity around the Cutoff

Table 1: No. of Science Courses

Multiple Bandwidths

	99	199	299	399	499
Discontinuity	2.44*	2.17*	1.82*	1.52*	1.30*
Covariates	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes
N	6,949	15,158	23,300	30,090	34,872

The regressions estimate the discontinuity in number of alternative science as a result of a district's serving 500 or more high school students or not for 2010-11 & 2015-16.
* p<0.05, **p<0.01, ***p<0.001

Results

Table 4u: STEM Majors at 4-year College Enrollment

Multiple Bandwidths

	149	199	299	399	499
Discontinuity	0.037	0.043	0.030	0.011	0.013
Covariates	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes
N	4,743	5,801	9,338	12,530	14,807

The regressions estimate the discontinuity in STEM majors at 4-year college enrollment as a result of a district's serving 500 or more high school students or not for 2010-11 & 2015-16, for the subsample who were enrolled in a 4-year college in Texas. * p<0.05, **p<0.01, ***p<0.001

Discussion

This paper finds that having access to one more alternative advanced science course in high school doesn't significantly increase STEM major choices in college. One possible explanation is that the effects studied in this paper is on an intensive margin – students in both larger and smaller districts have increased access to the courses.

The next step is to implement a RD Diff-in-Diffs model and compare the discontinuities across time.

Contact: Email: ameruszhang@tamu.edu. Phone: 979-575-0666